The Effect of Flipped Classroom Model on Students’ Performance in Grade 10 Chemistry
Dennis E. Fortuno, Jhonner D. Ricafort
Department of Education
Bulusan National High School, Bulusan, Sorsogon, Philippines
Sorsogon State College, Sorsogon City, Philippines

Abstract:
This study determined the effect of the flipped classroom model on students’ performance in Grade 10 Chemistry at Bulusan National High School, for school year 2019-2020. True Experimental research was employed using the pretest-posttest comparison design. The Table of Specification (TOS), pretest/posttest, detailed lesson plans and lecture videos were the main instruments used in gathering data. The data were analyzed and interpreted using appropriate statistical measures and tools. The results revealed that the control group and experimental group equally performed low in the pretest. There was no significant difference between the pretest results of the control group and experimental group. On the other hand, there was a significant difference among the performance of the two groups in the posttest. The experimental group who was taught using the flipped classroom model performed better than the control group taught using the conventional method of instruction. The flipped classroom model is an active, student-centered approach that was formed to increase the quality of period within class be used by the teachers. In order to compensate the educational demands of 21st century students, it is important to use innovative approaches in education. The flipped classroom model be used by the teachers in order the teaching strategy relevant to learners since most of them have an access to internet, learning and information can be learner-initiated by providing lecture videos.

Keywords: flipped classroom, effect, chemistry, 21st century, lecture videos.

I. INTRODUCTION
Science is a multifaceted discipline and systematized body of knowledge. It provides ways of making sense of the world systematically and has made it possible for man to know more about the universe. It greatly develops students’ scientific inquiry skills, values and attitudes, such as objectivity, curiosity, honesty and habits of mind including critical thinking. He effective teaching of science subjects can lead to the attainment of scientific and technological greatness (Adesoji & Olatunbosun, 2008). This is the very reason why varied teaching techniques in science have evolved through the past decades to change the way students learn new material. Students who manipulate scientific ideas using hands-on/minds-on strategies and activities are more successful than peers who are taught by teachers relying primarily on lecture and the textbook (Lynch & Zenchak, 2002). Effective science instruction capitalizes on questioning, offers opportunities for students to integrate prior knowledge with new information and skills, and encourages reflection (Leonard, Gerace, & Dufresne, 1999). For some students, learning Science is difficult. It is argued that science's reputation as a “hard” subject can be attributed to intrinsic features of science and/or learners. It is suggested that certain extrinsic features of science education, resulting from choices by science educators, exacerbate these intrinsic difficulties (Millar, 1991). For several years Science education researchers are incessantly developing an engaging and motivating classroom environment, student-centered classroom instructional strategies that will really cater their needs and making it relevant to them. We are now in the 21st century where students are in need of adapting the 21st century skills. In today’s science world, teachers, instructors and faculty in places of teaching and learning are finding it difficult to manage pedagogical practices at the speed of learner’s life world, with often larger classes, more diverse learners, demands from school authorities who want more accountability and the development of 21st century science graduates who are workforce ready in a competing fourth industrial revolution (4IR) era. To handle change of this nature, science teachers and instructors need to transform their pedagogical practices to involve decisions about what to teach in science lesson activity, what learners learn, why teach it, and how can it be presented to help digital and social generation of learners better understand it, and above all, improvisation among other things (Iwuanyanwu, 2019). Republic Act No. 10533: “An Act Enhancing the Philippine Basic Education System by Strengthening Its Curriculum and Increasing the Number of Years for Basic Education ,” otherwise known as Enhanced Basic Education Act of 2013 and along with this students and teachers are expected to become technologically, pedagogically, content and knowledge competitive in addressing the 21st century skills. In a curriculum that centers on learners’ performance, the attention shifts from the teacher to the students. One of the significant effects of this shift of focus in education is the birth of the “flipped classroom” approach. This approach refers to an active, student-centered approach that was formed to increase the quality of period within class indicating that what is done at school done at home, homework done at home completed in class (Sams and Bergmann, 2014). Furthermore, some Filipino students have gained recognition for their high level of accomplishments in the International Science and
Engineering Fair, Robotics Competition, and Physics Olympiad, to name a few. There are also reports of students in far-flung rural schools scoring much higher than the international mean in the case of the Third/Trends in International Mathematics and Science Study (TIMSS) or have gone beyond the 75% mastery level in the case of the National Achievement Test (NAT). However, the accomplishments of a few students are overshadowed by the consistently poor performance of Filipino students in international assessment studies and national assessment studies. Studies reveal that Filipino students have low retention of concepts, have limited reasoning and analytical skills, and poor communication skills (they cannot express ideas or explanations of events and phenomena in their own words. Many educators and graduate student researchers have identified several factors behind the low performance in science of Filipino students. These are: quality of teachers, the teaching-learning process, the school curriculum, instructional materials, and administrative support (DOST-SEI, 2006). Meanwhile, Bulusan National High School obtained an average MPS rate of 65.73% for the inclusive three school years for the National Achievement Test (NAT) in Science. In particular, the said school obtained an MPS rate of 71.28% in Science for school year 2012-2013, 79.89% in 2013-2014 and 46.03% in 2014-2015. Although, in the previous school years the school attained a passing mean percentage scores, the latter does not. The school should employ necessary intervention in order to sustain the accepted target mean percentage score of 75% by DepEd. It is also often observed that students are more engaged in the lesson if the teacher is employing multimedia presentations and technology in the discussion and not solely relying to modules reading it the whole time. The quality of science education in schools is greatly influenced by the quality of science teachers and the strategies and techniques used. Students’ interest in science is directly linked to the quality of teaching as well as learning interactions provided by the teacher. This research aims to enhance the academic performance in Science of Grade 10 students of Bulusan National High School in Science by utilizing teacher made and adapted online and offline videos which are accessible via Youtube, as well as individual and group worksheet activities in teaching Chemistry concept via flipped classroom model.

Nowadays, almost everyone has access to the internet because of this convenience, learning may be student-initiated and more meaningful. The researcher chose Chemistry as the subject on the employment of Flipped Classroom Model because most students are not that proficient in Chemistry since it includes some abstract concepts and mathematical integration that makes it more difficult to some based from the observation and results of exam of Science teachers in the said school. For many students, chemistry is seen as a difficult, complex and an abstract subject that requires special intellectual talents and a too much effort to be understood (Nakhleh, 1992). However, “…perhaps more than other sciences, understanding chemistry relies on making sense of the invisible and un-touchable” (Kozma & Russell, 1997). With this rationale, the utilization of technology and innovative teaching strategy are highly imperative in the field of education. In accordance, this study will provide a basis for feasibility analysis focusing on the employment of flipped classroom strategy as an innovative teaching strategy in teaching Science in Grade 10.

II. FRAMEWORK

The concept of the study was shown in figure 1. This was composed of the pretest of the control and experimental groups. The 40-item pretest was administered to control group and experimental group. After which, the control group was taught using the conventional teaching method while the experimental group was taught using flipped classroom model. The developed lecture videos and detailed lesson plan on gas laws and biomolecules were used in the flipped classroom model. After all identified topics for the study were learned, posttest was administered to control and experimental groups to evaluate the level of performance of both groups.

![Figure 1: Conceptual Paradigm](image)

III. OBJECTIVES OF THE STUDY

This study determined the effect of the flipped classroom model on the students’ performance in Grade 10 Chemistry at Bulusan National High School, for school year 2019-2020. Specifically, it sought to answer the following questions: 1.) What is the level of performance in the pretest of the control group and experimental group along the four topics: a. Boyle’s Law; b. Charles’ Law; c. Kinetic Molecular Theory and d. Biomolecules, 2.) Is there a significant difference between the level of performance in the pretest of the control group and experimental group? 3.) What is the level of performance of the control group and experimental group in the posttest along the said topics? And 4.) Is there a significant difference between the level of performance in the posttest of the control group and experimental group?

MATERIALS AND METHODS

Research Design

This study determined the effect of the flipped classroom model on the students’ performance in Grade 10 Chemistry at Bulusan National High School, for school year 2019-2020. The study used the Pretest-Posttest True-Experimental Design. The Table of Specification (TOS), 40-item pretest/posttest, detailed lesson plans and lecture videos were the main instruments used in gathering data. The study used percentage, mean and independent (uncorrelated) sample t-test as statistical tools to analyze the data samples of this study.

Research Site

The study was conducted at Bulusan National High School, Bulusan, Sorsogon.
Participants

The researcher conducted the experiment among grade 10 students of Bulusan National High School consisting of 40 students. There were 20 students in every group. Since the two groups are homogenous in nature, they have the same characteristics as a group hence, the two sections were determined as either control or experimental group using draw lots to employ randomization. In getting the target respondents, the researcher got the grades in Science of all the members of the two homogenous classes from their respective advisers from the first up to the third quarter and compute their average grades. Then, arranged their average grades from highest to lowest and remove the outliers to come up with the final 20 sample size in each group.

Instrumentation

The study used the following instruments: Table of Specification (TOS), Pretest/Posttest, Lesson Plans and Lecture Videos.

Table of Specification (TOS) and Pretest/Posttest

The Table of Specification (TOS) showed equal distribution of items per skill/learning competency in the test. The included topics in Grade 10 Chemistry were gas laws and biomolecules. Pretest/Posttest is a forty-item multiple choice test that measures the learning gain/effect of the intervention. First, the researcher made an 80-item test which was subjected for dry-run to determine its validity and reliability to Grade 11 students who are not respondents of the study. After the dry-run, the researcher conducted an item analysis to find out the number of items that need to be discarded and revised. After the item analysis, out of 80-item test on Grade 10 Chemistry, 40 items were removed from the test questions resulting to the final 40-item test. The final 40-item test was administered on January 13, 2020 to 50 students at Barcelona National Comprehensive High School to determine the reliability of the test using the Kuder-Richardson Formula 20 (KR20). The computed reliability coefficient was 0.743. This meant that the test questions were acceptable based on the scale adopted from the study of McGahee and Ball (2009)11.

Lesson Plan

The learning activities and different assessment methods in the lessons were adapted from the grade 10 Science learning module, other learning materials and trade books in science. The lesson plans were developed in order to facilitate lessons using flipped classroom model that integrated the 7 E’s model such as Elicit, Engage, Explore, Explain, Elaborate, Extend and Evaluate. The flipped lecture videos and flipping the classroom were interleaved in the Extend and Elicit parts of the 7 E’s model and if topics were just a continuation of the previous lesson, lecture videos were inserted every after the end of the session.

Lecture Videos

Lecture videos were teacher-made and adapted from Youtube and other educational videos resources. Topics in gas laws and biomolecules were presented through multimedia as videos. For Boyle’s Law, it is composed of four lecture videos. Lecture Video No. 1 is entitled Measurable Properties of Gas with the entire duration of 1 minute and 25 minutes, Lecture Video No. 2 entitled Conversion Units for the Measurable Properties of Gas with a duration of five minutes and forty-one seconds. Lecture Video No. 3 is entitled Boyle’s Law (Part 1): Volume-Pressure Relationship at constant Temperature of a Gas with five minutes and eighteen seconds duration and lastly Lecture Video no. 4 entitled Boyle’s Law (Part 2): Mathematical Expression of Boyle’s Law having seven minutes and five seconds length. On the other hand, Charles’ Law includes three lecture videos. Lecture Video No. 5 is entitled Charles’ Law (Part1): Volume-Temperature Relationship at constant Pressure of a Gas with a duration of two minutes and fifty-seven seconds. How to Make a Mini Hot Air Balloon video has seven minutes and fifty-two seconds duration. While the Lecture Video No. 6 entitled Charles’ Law (Part 2): Mathematical Expression of Charles’ Law has six minutes and fifty-five seconds length. Kinetic Molecular Theory is comprised of one lecture video. Lecture Video No. 7 is entitled Assumptions of the Kinetic Molecular Theory with a six minutes and fifty-nine seconds duration. Finally, three lecture videos are included in Biomolecules. Lecture Video No. 8 entitled Biomolecules- Carbohydrates has a one minute and fifty-one seconds duration. Meanwhile, Lecture Video No.9 entitled Biomolecules-Lipids has a duration of two minutes and forty-six seconds and Lecture Video No. 10 entitled Biomolecules- Proteins and Nucleic Acid having three minutes and seven seconds duration.

Validation of Instrument

The teacher-made test was checked and validated by one master teacher in science and four seasoned science teachers using an expert assessment tool. Most of them commented and suggested more on the parallelism of the test items to the learning competencies as well as to revision of some questions to make it fit to the target levels of skills. After some revisions were made on the pretest/posttest, the researcher consulted again the experts. Before the finalization, the researcher consulted his adviser for additional comments and suggestions. The experts who validated the developed lesson plans were two master teacher in Science and three science teachers using the Learning Resource Materials Development System (LRMDS) of DepEd. Experts commented to indicate the instances where the classroom was flipped considering the essential features of classroom model. Five factors of the evaluation rating were: Content, Format, Presentation and Organization, Accuracy and Up-to-Datedness of Information and Addressing the Flipped Classroom Model with mean scores of 28 out of 28, 72 out of 72, 20 out of 20, 23 out of 24 and 20 out of 20, respectively. Each criterion passed the evaluation made by experts. The lecture videos were validated through a validation tool adapted from Learning Resource Materials Development System (LRMDS) of DepEd by two master teachers in Science, three science teachers, one English subject teacher and one expert in IT. Four factors of the evaluation rating were: Content Quality, Instructional Quality, Technical Quality and Other Findings with mean rating of 40 out of 40, 40 out of 40, 52 out of 52 and 15 out of 16, respectively. Each criterion got a passing mean rating. According to experts, the lecture videos were carefully designed
to address a particular competency making them direct and highly relevant to the topic. The experts recommended the approval of the developed lesson plan and lecture videos on gas laws and biomolecules for public use provided that the corrections/revisions were made.

**Data Collection**

Before the conduct of the study, the researcher prepared a request letter addressed to the schools division superintendent for proper approval. The researcher also asked permission from the School Head/Principal and Science Department Coordinator through formal letter to administer the test and to gather the data and information significant to the study. After the approval was granted, the researcher personally conducted the pretest on January 20, 2020 to the control group and experimental group. The respondents were given instructions on the manner of answering the test. They were given one hour to answer the 40-item multiple choice test. The test papers and answer sheets were retrieved by the researcher right after the examination and the results were checked, recorded and made available for statistical interpretation. The class of the experimental group was scheduled at 3:00-4:00 PM while the control group was scheduled at 4:30-5:30 PM. Orientation about what flipped classroom was all about was done on the first session to the experimental group. The researcher also asked the experimental group to create a messenger group chat exclusively for them. The group chat was the site where the lecture videos were sent every after class. Experimental group received the lessons on gas laws and biomolecules in Grade 10 Chemistry using the Flipped Classroom Model. Lecture videos on gas laws and biomolecules were provided by the teacher and given to the experimental group as an assignment. The students watched the lecture video at home or during their free time at school and take notes and questions on their notebook. Upon meeting for instruction, the students will engage in a group discussion about the video then perform varied student-centered activities. On the other hand, control group was taught using conventional method with the same subject matter. The control and experimental groups were personally taught by the researcher with the same subject matter.

The identified topics learned by the respondents were gas laws specifically on Boyle’s Law, Charles’ Law and Kinetic Molecular Theory and also includes topic on Biomolecules. These topics were taken from the K to 12 Curriculum Guide of DepEd. After discussing all identified topics in gas laws and biomolecules, posttest was administered on February 14, 2020 to control group and experimental group. The respondents were oriented about the nature of the test. They were given enough time to answer the test questions. The test papers and answer sheets were collected right after the time had finished and subjected for checking and recording purposes. The data gathered were tallied, analyzed and interpreted with the use of statistical tools to determine the level of performance and the difference in the performance of the two groups of respondents. The entire duration of the activity lasted for 20 school days starting from the pretest to the posttest.

**Data Analysis**

The students’ test results in the pre and post tests were checked, tallied, analyzed and interpreted. The mean, frequency count and percentage were used to determine the level of performance in the pretest and posttest of control and experimental groups. The researcher adopted the scale from DepEd Order No.8, s. 2015 to determine the performance level and description of the students in the pretest and posttest. To test whether there is a difference in the performance level of the control and experimental groups during the pretest, t- test for independent (uncorrelated) data was used. This was also employed in testing the difference between the level of performance of the control and experimental groups during the posttest.

**IV. RESULTS AND DISCUSSION**

<table>
<thead>
<tr>
<th>Topics</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boyle’s Law</strong></td>
<td>52.69%</td>
<td>53.46%</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Did Not Meet the Expectations</td>
<td>Did Not Meet the Expectations</td>
</tr>
<tr>
<td><strong>Charles’ Law</strong></td>
<td>48.50%</td>
<td>47.50%</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Did Not Meet the Expectations</td>
<td>Did Not Meet the Expectations</td>
</tr>
<tr>
<td><strong>Kinetic Molecular Theory</strong></td>
<td>50.00%</td>
<td>51.00%</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Did Not Meet the Expectations</td>
<td>Did Not Meet the Expectations</td>
</tr>
<tr>
<td><strong>Biomolecules</strong></td>
<td>49.17%</td>
<td>48.75%</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Did Not Meet the Expectations</td>
<td>Did Not Meet the Expectations</td>
</tr>
</tbody>
</table>

Table 1 showed the level of performance of the control group and experimental group in the pretest along the four topics in Grade 10 Chemistry such as Boyle’s Law, Charles’ Law, Kinetic Molecular Theory and Biomolecules. The rating obtained by the students was expressed in percentage score or percent of correct responses. As reflected in the table, both control group and experimental group got a low rating in the pretest along the four topics. The ratings of both groups were

http://ijesc.org/
described as *did not meet the expectations*. Result also showed that the two groups of respondents may have the same prior knowledge on the four topics in Grade 10 Chemistry.

The result inferred that the students scored low in the pretest in both groups. This may be attributed to the spiral progression of topics under K to 12 Curriculum in which concepts on the relationship of the measurable properties of gases as well as concept in biomolecules were not introduced in their previous grade levels. It is said that students are not expected to know the answers to all of the questions in a pretest, however, students should be expected to utilize previous knowledge to predict rational answers. (Kuehn (2019)\(^\text{12}\)).

Nonetheless, the sole background of the students prior to these lessons was the basic concepts on the properties of the states of matter including gas which are being taught in Grade 8 Chemistry while some concepts on biomolecules is also being taught in other subject areas such as Grade 10 MAPEH, particularly in Health but these are not enough to fully understand the relationship of the measurable properties of gas as well as recognize biomolecules since it requires integration of the concepts in the new topics. Thus, it is helpful for students to be provided with the opportunity to recall the previous lessons and elicit their prior knowledge so that it could facilitate the learning of gas laws and biomolecules with increasing complexity.

Further, the descriptive rating *did not meet the expectations* meant that the students needed more improvements in terms of achieving the target performance level of 75% by DepEd Order No.8, s. 2015. This result was similar to the study of Escultura (2019)\(^\text{13}\), on the study of the effectiveness of the Whole Brain Teaching Strategy (WBTS) in teaching Waves. He revealed that the level of performance in the pretest of the control group and experimental group was equal. This meant that the two groups may have the same knowledge and skills in the subject matter prior to the intervention used by the teacher.

<table>
<thead>
<tr>
<th>Statistical Basis</th>
<th>Statistical Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Significance</td>
<td>0.05</td>
</tr>
<tr>
<td>Degrees of Freedom</td>
<td>38</td>
</tr>
<tr>
<td>Critical Value</td>
<td>2.02</td>
</tr>
<tr>
<td>Computed t-value</td>
<td>-0.0525</td>
</tr>
<tr>
<td>Decision on Ho</td>
<td>Do not Reject</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Table 2 depicted the difference between the pretest results of the control group and experimental group. It revealed that at 0.05 level of significance and 38 degrees of freedom, the computed t-value for independent sample was -0.0525 that is within the critical value of 2.02.

Therefore, the null hypothesis cannot be rejected. Hence, there is no significant difference between the pretest results of the control group and experimental group. This finding meant that the two groups of respondents equally performed in the pretest may have the same experience in the previous grade level and considering the two groups belong to a homogenous class.

The pretest results meant that the learners may have similar ideas about the topics presented in Grade 10 Chemistry because according to the spiral progression approach, the scope and sequence of the content were developed such that concepts and skills revisited at each level with increasing depth. According to Tan (2012)\(^\text{14}\), spiral progression means developing the same concept from one grade level to next in increasing complexity and sophistication. Since the learners have no basic knowledge yet on the relationship of measurable properties of gas and concept on biomolecules in lower grade levels, low level of performance in the pretest may be expected. Moreover, other factors may be attributed to the similarity of the performance of the two groups in the pretest. Since the two groups have been taught by the same teacher before, it is deduced that they may have same experience in the previous level.

The use of instructional materials utilized by their previous teachers in teaching Chemistry may be one of the factors. Based from NTI (2007)\(^\text{15}\), Chemistry as a subject is activity oriented and the suggested method for teaching it which is guided discovering method is resource based. This suggest that chemistry concepts cannot be fully achieved without the use of instructional materials.

The teaching of chemistry without instructional materials will certainly result to poor performance in the course.

This was supported by the study of Karemera (2003)\(^\text{16}\), she found out that students’ performance is significantly correlated with satisfaction with academic environment and the facilities of library, computer laboratory, science laboratory and etc. in the institution. Thus, instructional materials are used to monitor students’ assimilation of information and if not effectively used may not be that engaging and will not improve students’ knowledge, abilities and skills. Another is the choice of pedagogical techniques and strategies employed by their former Science teacher.

Adunola (2011)\(^\text{17}\) indicated that in order to bring desirable changes in students, teaching methods used by educators should be best for the subject matter. Similarly, Chang (2002)\(^\text{18}\) sustained that teaching methods work effectively mainly if they suit learner’s needs since every learner interprets and respond to questions in a unique way.

As such alignments of teaching methods with students needs and preferred learning influence students’ academic performance. If the students are not totally engrossed in the lesson, transfer of learning might not be that efficient.
Table 3. Level of Performance of the Control and Experimental Groups in the Posttest along the Four Topics

<table>
<thead>
<tr>
<th>Topics</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rating</td>
<td>Description</td>
</tr>
<tr>
<td>Boyle’s Law</td>
<td>75.38%</td>
<td>Fairly Satisfactory</td>
</tr>
<tr>
<td>Charles’ Law</td>
<td>69.00%</td>
<td>Did Not Meet the Expectations</td>
</tr>
<tr>
<td>Kinetic Molecular Theory</td>
<td>67.00%</td>
<td>Did Not Meet the Expectations</td>
</tr>
<tr>
<td>Biomolecules</td>
<td>82.92%</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

Table 3 reflected the level of performance of the control and experimental groups in the posttest along the four topics. As reflected, control group got a highest rating in Biomolecules which was 82.92%, described as Satisfactory and lowest in Kinetic Molecular Theory which was 67.00%, described as did not meet the expectation. Meanwhile, experimental group got 91.67% in Biomolecules being the highest rating, interpreted as outstanding and 80.00% in Charles’ Law being the lowest rating, interpreted as very satisfactory. Result revealed that there were improvements in the posttest performance of the students on the four topics in Grade 10 Chemistry. However, the posttest performance of control group along the topics Charles’ Law and Kinetic Molecular Theory though it increased as compared to the pretest still it did not meet at least 75% expected performance target as per DepEd Order No. 8, s. 2015. Furthermore, among the four topics, Boyle’s Law and Biomolecules were the topics that the control group attained the target of at least 75% performance. As compared to the performance in the pretest of the experimental group (see Table 1), it can be observed that there was a significant increase in their ratings. The improvements of the ratings may be attributed to the use of flipped classroom model where the students were actively engaged in the teaching and learning process compared to that of the control group. The use of video lectures coupled with worksheets or some form of formative/summative technique was also supported by Moravec et al., (2010) to increase overall performance in the class by up to 21%. This technique has also been shown to increase scores on individual homework assignments, projects and tests (Day & Foley, 2006).

These findings meant that flipped classroom model may have improved the level of performance of the experimental group on the four topics in Grade 10 Chemistry. There are many advantages of flipped classroom approach. The most important one is it increases the interactive period within the class (Fulton, 2012). By means of lecture videos the teacher uses the time for the interaction between teacher and student rather than for teaching. Accordingly the teacher can spare more time to fulfill the learning and emotional demands of students (Goodwin & Miller, 2013). In flipped classroom approach the students can find opportunity to discuss with their teachers which is not a possible situation in traditional approach (Bergmann & Wadell, 2012).

Table 4. Difference between the Performance of the Control and Experimental Groups in the Posttest

<table>
<thead>
<tr>
<th>Statistical Basis</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Significance</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Degrees of Freedom</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Critical Value</td>
<td>2.02</td>
<td></td>
</tr>
<tr>
<td>Computed t-value</td>
<td>6.40</td>
<td></td>
</tr>
<tr>
<td>Decision on Ho</td>
<td>Reject</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>Significant</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 presented the difference among the performance of the control and experimental group in the posttest. As reflected, the computed t-value of 6.40 based from the posttest performance of the two groups was greater than the critical value of 2.02. This meant that the null hypothesis was rejected. Therefore, the posttest performances of both experimental and controlled groups had significant difference. The table showed that the two groups performed differently when they are exposed to different methods of teaching. It showed that the experimental group had better performances which may be attributed to the use of flipped classroom model and is effective to improve students’ performance. Through the efficient use of class time for deepening of concept understanding and skill fluency, the flipped learning method served as an effective approach to improve retention and learning transfer. Learner retention is better improved in the flipped classroom because the students control their own pace of learning (Estes, Ingram, & Liu, 2014). This was also suggested by Mayer (2002) that the
flipped approach to learning facilitates long term retention and application of course material, as opposed to simple transfer of knowledge and facts, as is the case in traditional classrooms. Moreover, as experienced by the researcher during the employment of flipped classroom model, teacher in flipped classroom also tend to focus on students during in-class group activities and more importantly, they implement strategies that could enhance the behavior of students like focusing on the class activities and time management, and adopting meta-cognitive strategy like providing feedback, assisting in reflection in pre-class learning, and group work facilitation in class. These were evident while employing the flipped classroom approach that might also facilitate to the improvement of students’ performance. Moreover, because of lecture videos, the students come to school already equipped with the theoretical part of the lesson and will only deepen the concept by performing varied student-centered activities during in-class time. After the students have watched the video at home or during their free time at school and take notes and questions on their notebook, they come prepared. Upon meeting for instruction, the students engage in a group discussion about the video then perform varied application activities. These may be helped in the improvement of students’ performance because making the content relevant not only helps students master it more effectively- by applying it to situations they understand but helps them understand the importance of learning the content and therefore be more motivated for doing so. The result of posttest is in consonance to the study of Camiling (2017)\(^2\)\(^6\) wherein he revealed that there is also a significant difference between the test performances of the students in the two groups which widens the scope of Flipped Learning’s effectiveness as applied in school settings.

V. CONCLUSION

It was concluded in this study that the control group and experimental group performed very low in the pretest along the lessons on Boyle’s Law, Charles’s Law, Kinetic Molecular Theory and Biomolecules. Both groups did not attain the minimum grade requirement of 75% as per DepEd Order No.8, s. 2015. There was no significant difference between the pretest results of the control group and experimental group. The two groups of respondents equally performed low in the pretest. The experimental group showed a higher performance in the posttest than the control group along the lessons on Gas Laws and Biomolecules. The Flipped Classroom Model helped improved the level of performance of the students in the posttest. Hence, The Flipped Classroom Model is effective in enhancing the performance of the students in Grade 10 Chemistry.

VI. REFERENCES


[13]. Escultura, Joebert (2019). The Whole Brain Teaching Strategy (WBTS) in teaching Waves for grade 7 students. Published Master’s Thesis .Sorsogon State College, Sorsogon City,Philippines


[17]. Adunola, O.(2011),"the Impact of Teachers’ Teaching Methods onThe Academic Performance of Primary School pupils


